TELLING THE STORY

What type of stories do you want to tell?

- **Science** — share your data and your findings and conclusions as they relate to your objectives.
- **Community** — share human interest stories such as volunteer participation, community engagement, and success stories.
- **Future** — share how the information you collected will help you improve water quality or plan for the future.

Tips for reporting:

- Focus more on what you found than on what you did.
- Provide context for why the information is useful.
- Think about the audiences that you're trying to reach – use plain language to appeal to everyone.
- Be creative! Consider multiple formats for sharing information depending on the audience (e.g., websites, written reports, maps or story maps, videos, media coverage, public presentations, volunteer recognition events).
- Visualize your data to help tell the story — use infographics, maps, story maps, graphs, charts, etc.
- Highlight the volunteer component and let people know how they can get involved.

LESSONS LEARNED & CONTINUAL IMPROVEMENT

At the end of your field season, when all monitoring is complete and the season is still fresh in your mind, take time to reflect on how it went:

- What was successful?
- What didn't go according to plan?
- How can things be improved for next time?
- Pay close attention to data quality issues – what do you think caused the problem and how can you avoid them in the future (e.g., additional training or oversight for volunteers, better communication with the lab)?

Consider writing lessons learned in a brief year-end review to accompany your SAP. This will help to make it easier to revise your SAP for future monitoring efforts.

Consider using surveys to solicit feedback from participants.

HAVE FUN!

Positive volunteer monitoring experiences can build a lasting sense of place and promote stewardship.

- Be as organized as possible to make it as easy as possible for volunteers to participate.
- Be flexible and build in back-up plans to accommodate volunteers' schedules.
- Develop a SAP that is achievable — carefully choose field methods, site locations, sampling events, etc.

CONTACT INFORMATION

If you have questions or are interested in learning more about volunteer monitoring, please contact:

Katie Makarowski, Montana Department of Environmental Quality, kmkarowski@mt.gov, 406-444-3507

Adam Sigler, Montana State University Extension Water Quality Program, asigler@montana.edu, 406-994-7381

VOLUNTEER MONITORING PLANNING CATALOGUE

This guide covers key considerations for each step of planning a successful monitoring project and highlights key resources available to help you. Review this guide before you start and refer to it throughout the planning process.

DEQ MONTANA

MONTANA STATE UNIVERSITY EXTENSION

THE SPARK

Why do you want to monitor water quality?

What questions will data help you answer?

GOALS = desired outcomes

Goals can be broad and help you articulate your interests, concerns, motivations, and what you hope to achieve.

Common water quality monitoring goals include:

- Evaluating current conditions
- Establishing a baseline for future comparisons
- Identifying sources of pollution
- Evaluating if projects effectively improved water quality
- Analyzing trends over time

Start planning at least a year in advance:

- Time is valuable
- Avoid collecting data that already exists, isn't useful, or that you don't know how to interpret.
- Monitoring requires knowledge, skill, equipment, and time – prepare in advance.

PLAN AHEAD

For guidance on developing goals and objectives, see

"Water Resource Monitoring Methods Selection Guide"

(MMSG)

(Makarowski and Sigler, 2019)

START WRITING A SAMPLING AND ANALYSIS PLAN (SAP)

What is a SAP?

A document that describes your goals, monitoring objectives, and the procedures you will use to collect and analyze data to achieve them.

Why write a SAP?

- Improve the quality of your data.
- Communicate your objectives and instructions to volunteers, labs, funders, boards, etc.
- Documents which methods were used for people using your data in the future.

Audience

Consider who will use your SAP and what their level of technical expertise is.

Approval

Who must approve your SAP and what are their approval criteria?

Use a SAP template to guide your writing:

- Start by drafting your goals and project background.
- Use placeholders and fill in the details as you proceed through the steps and develop your plan.

Include these sections:

- Introduction (Overview, goals, monitoring objectives)
- Project Team and Responsibilities
- Sampling Design (parameters, site locations, sampling schedule, field and lab methods, forms)
- Quality Assurance and Quality Control
- Data Management and Record Keeping
- Data Analysis & Reporting
- Health & Safety
- Budget

Finalize your SAP before your first monitoring event.

GET ACQUAINTED WITH YOUR WATERSHED

LEARN ABOUT WATER QUALITY

Before you develop monitoring objectives and select parameters, you should become familiar with concepts and terms related to the water quality issues you are interested in.

Online resources include:

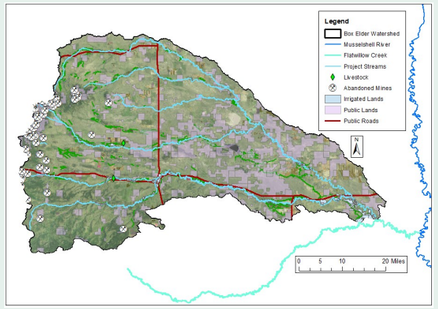
- USGS Water Science School
- EPA Water Topics
- MWCC Monitoring Resource Library
- MSU Extension Water Quality website & videos
- Montana water quality standards
- Montana water quality code (§75-5, MCA) and rules (ARM 17.30)

You can also contact water resource professionals at natural resource agencies, watershed groups, conservation districts, etc.

CREATE MAPS

Maps help you visualize your watershed and become familiar with the characteristics that are likely to influence water quality (e.g., geology, climate, ecoregion, land cover, human activities and land use).

Electronic mapping tools are available (e.g., Google Maps, ArcGIS) and the Montana State Library Geographic Information Clearinghouse has additional resources.



CONDUCT RECONNAISSANCE

Trek around your watershed to make observations about water quality and natural features; record your observations and take photos. Your notes and directions will be helpful as you develop your sampling plan.

Montana Major River Basins

COMPILE EXISTING DATA

Gather and review available data and information from publicly available databases or other sources:

- National Water Quality Portal
- USGS National Water Information Center
- Mapping DEQ's Data
- MSUEWQ's Data Hub
- Montana Integrated Report and list of impaired waters: Clean Water Act Information Center
- EPA's How's My Waterway

People...WHO?

Who will collect data?

- Volunteers? Staff? Students? Contractors?

Who can you partner with?

- Watershed groups, conservation districts, water quality districts, state or federal agencies, schools?

Who will you share data with?

- This will help determine the level of data quality needed and how the data must be managed.

See Montana Watershed Coordination Council's "Water Monitoring Programs" map

Who on your project team will perform key tasks?

- Recruit and train volunteers, secure funding, maintain and calibrate equipment, collect field data, deliver samples to lab, review data quality, manage and enter data into database, analyze data, develop reports, give presentations, etc.

See "Starting a Volunteer Monitoring Program" (MSUEWQ) and DEQ "Volunteer Monitoring SAP Template" (DEQ)

For useful tips on recruiting participants and building a sustainable volunteer program, see:

Starting a VM Program

(Sigler, 2019)

VOLUNTEER RECRUITMENT AND RETENTION

Consider the motivations of volunteers:

- Want to learn something new?
- Make a difference for their community?
- Improve environmental conditions?
- Meet people?
- Spend time outside?

Acknowledge and accommodate those motivations to recruit and retain volunteers.

Make it fun and celebrate achievements!

TRAINING FIELD CREWS

- Provide adequate training and require that all participants attend annually.
- In-person trainings are preferred but videos and instructional SOPs can be used to supplement and remind.
- Perform field audits in which an experienced person oversees less experienced people to verify that procedures are being properly and consistently followed.
- At the beginning, consider having volunteers do side-by-side collections and compare results as a QC check.

HEALTH & SAFETY

Stress the importance of safety — personal well-being is far more important than data!

Be prepared:

- Always carry first aid kits
- Wear personal protective equipment (e.g., gloves, glasses, PFDs, waders, wader belts)
- Acquire first aid and CPR training

Be aware of risks and take measures to minimize them:

- Chemical safety (e.g., skin or eye irritation, inhalation)
- Boating, wading, slips, trips & falls
- Weather, wildlife and other environmental risks

Create a communication and emergency response plan:

- Make a schedule so you know who is in the field, where and when; consider asking people to check in upon return so you know they are safe and requesting emergency contact information just in case.

BUDGETING AND FUNDING

Develop a budget

and stick to it!

- Take stock of what resources you already have available
- Identify and budget for all anticipated costs (e.g., staff time, lab analytical costs, equipment, supplies, mileage, training, data management, equipment maintenance)
- Develop a plan to acquire get the resources you need (e.g., fundraising, grants)

Several entities have resources available to support volunteer monitoring efforts:

DEQ's Volunteer Monitoring Support Program

Soil & Water Conservation District Mini Grants

MWCC Watershed Fund

QUALITY CONTROL SAMPLES

QC samples help detect errors and evaluate whether field crews are producing high quality, comparable data.

FIELD DUPLICATES

Field duplicates are two samples collected as close as possible to the same place and time by the same person and carried through all steps of sampling collection, preservation, storage, and analysis in an identical manner. Field duplicates are used to evaluate precision of sampling and analysis methods and help to verify that proper procedures are being followed consistently. Field duplicates are analyzed by calculating the relative percent difference (RPD) between the two samples. Typically, field duplicates are collected at a rate of 10% of the total number of routine samples collected for a project.

FIELD BLANKS

A field blank is a samples of analyte-free, laboratory-grade deionized water poured into a sample container in the field using the same method, container, and preservation as routine samples, and submitted to the lab alongside other field samples. Field blanks are used to detect potential sources of contamination. Analytes should not be detected in field blanks and, if they are, there is a high likelihood of contamination. Typically one field blank per analyte is submitted per batch of samples submitted to the lab.

DATA MANAGEMENT

Identify each type of data that your project will produce and plan ahead about how you will manage each:

- Select the database(s) you will enter lab results and field measurements into. Format your data according to the database's specifications (e.g., column headings, metadata, naming conventions). Follow the process for validating your data and use appropriate data flags to indicate errors.
  - DEQ's MT-eWQX (EQuIS) database
  - MSUEWQ Data Hub
  - National Water Quality Portal
- For photos, field notes and other data that doesn't get entered into a database, determine how you will manage, store and archive it (e.g., file naming conventions for photos, scanning field forms, backing up files).

DATA ANALYSIS

Picture yourself just after you finish collecting data - now what? Develop a plan for how you will analyze each type of data.

Refer to your goals and objectives:

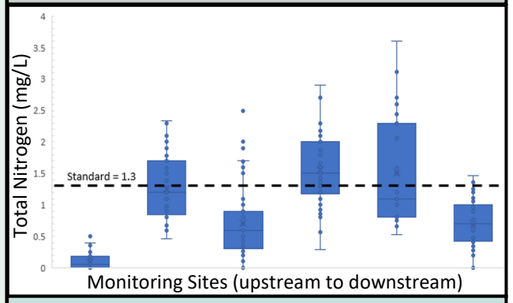
- Which thresholds will you compare your data against?
- Which summary statistics are meaningful? (e.g., mean, median, minimum, maximum, percentile)
- Which statistical tests will you use to evaluate significance of relationships or trends in your data?
- Will you calculate loads using concentration and flow?
- Will you compare one dataset to another?
- Will you compare existing conditions to a reference (minimally-disturbed) condition?

REPORTING LIMITS

The lab's ability to detect a substance in a sample depends on the analysis method, skill and experience of the analyst, instrument quality, and other factors. Just because a lab doesn't detect a substance doesn't mean the substance is absent from the sample, it simply means that the concentration is lower than what they could detect.

Reporting Limit (RL) = minimum value below which data are documented as non-detects.

State the reporting limit for each analyte in your SAP and ensure it is low enough for your needs. If you plan to compare your result values to a threshold, the reporting limit must be lower than the threshold or you will not know how to interpret a non-detect result.



For instructions on a few common analyses, see "Data Analysis Guide" (Sigler, 2019)

CLEARLY ARTICULATE YOUR SPECIFIC AND MEASURABLE MONITORING OBJECTIVES

Start with the word "To" and include four elements:

1. Parameters...WHAT

What types of data will you collect?

- Which parameters are relevant to your interests & questions?
- Consider chemical, biological, and physical parameters.

2. Location...WHERE?

Describe the scale and location of your monitoring:

- Which watershed? Which waterbodies? Which sites?

Include a list of proposed sites in your SAP:

- Provide latitude and longitude coordinates.
- Describe the rationale for selecting each site.

When selecting sites, consider:

- How many sites are needed to represent conditions?
- How many sites are feasible to visit each sampling event?
- Where are potential sources of pollution located?
- Whether to stratify the waterbody into homogenous reaches?
- Landownership, ease of access and ability to return.

3. Timing...WHEN?

Determine an appropriate and feasible monitoring schedule as it relates to your parameters of interest and intended analyses.

- Which months are relevant? (e.g., do factors like time of year, flow, temperature or light affect your parameters?
- Which days are practical? (e.g., when are volunteers available and will weekends affect your ability to ship samples within allowable holding times?)
- How many visits will you make to each site, and how much time should pass between visits?
- Over how many years will you monitor?

4. Context...WHY?

Although your goals help to explain why you are monitoring, you can incorporate additional context into your monitoring objectives to help explain why your parameters, locations, and timing are relevant.

Examples

"To compare **nitrate concentrations** in **Beaver Creek upstream and downstream from Anytown during July and August** to determine **whether leaking septic systems appear to be a source of excess nutrients**."

"To evaluate whether excess **fine sediment** is depositing in **riffles in Deer Creek during baseflow**, thereby **limiting fish and insect habitat**."

"To measure **nitrogen, phosphorus and discharge** to determine which of **five tributaries to Rock Creek** are contributing the highest nutrient loads **during spring runoff to inform restoration priorities**."

HOW WILL THE DATA BE COLLECTED?

STANDARD
OPERATING
PROCEDURES

Select a monitoring method for each parameter.

Ensure the method you choose:

- Is feasible based on the knowledge and expertise of the people who will collect the data.
- Will produce data that meets your data quality objectives; for example, will it produce data that is comparable to data collected in the past by your program or others?

Include SOPs as a stand-alone document or as a section in your SAP to provide clear step-by-step instructions for use in the field.

For guidance on selecting parameters and monitoring methods, see "Water Resource Monitoring Methods Selection Guide" (Makarowski and Sigler, 2019)

EQUIPMENT AND SUPPLIES

Determine what you need and consider:

- Which equipment has the specifications/sensitivities to produce data that meets your data quality objectives?
- Whether to buy or borrow — many items are available for loan from DEQ and MSUEWQ.
- Long-term maintenance and costs.

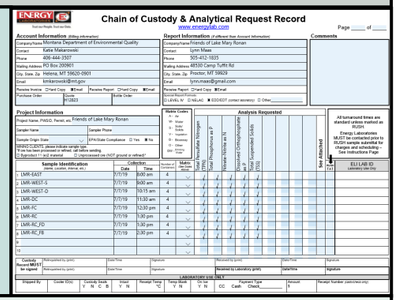
BEFORE: Calibrate and test your equipment to learn how to use it and make sure it works.

DURING: Monitor the condition of your equipment and address any concerns or repairs.

AFTER: Clean, dry and store equipment properly.

FIELD FORMS AND DOCUMENTATION

- Standardize forms to produce consistent records through time
- Verify which metadata (data about data) you need to record
- Review field forms for accuracy and completion in the field
- Use waterproof paper
- Use legible handwriting!
- After monitoring, scan and archive field forms for future reference



LANDOWNERSHIP AND PERMISSION TO ACCESS

- For each monitoring site, use Cadastral to determine who owns the land.
- Before visiting sites, contact private landowners to ask for permission to access their property to collect data. If needed, choose alternative sites that represent similar conditions based on the outcome of landowner contacts.
- Provide field crews with landowner names, contact information, and any special instructions to promote positive landowner interactions and to avoid trespassing.

HOW CAN YOU BUILD QUALITY ASSURANCE AND QUALITY CONTROL INTO EACH STEP OF YOUR PROJECT?

QUALITY ASSURANCE (QA)

= overall system to ensure a monitoring project produces data of the desired level of quality

Examples of QA activities:

- Developing SAPs
- Training field crews
- Communicating analytical requirements to labs
- Using standard operating procedures

QUALITY CONTROL (QC)

= technical activities used to detect and control errors

Examples of QC activities:

- Collecting field duplicates
- Preparing field blanks
- Calibrating equipment
- Reviewing field forms for accuracy

ANALYTICAL LABORATORIES

DETERMINE WHICH "ANALYTES" YOU WILL HAVE A LAB ANALYZE FOR YOU.

Specify analytical requirements for each analyte:

- Volume of sample required
- Sample container material (e.g., plastic, glass)
- Preservation (e.g., ice, frozen, add acid?)
- Holding time allowed between sample collection and lab delivery
- Analytical methods
- Required reporting limits

Determine which labs to send samples to:

- Can they perform the analytical methods you require?
- Can they achieve the reporting limits you require?
- How do costs compare between labs?
- Which labs are most conveniently located for sample delivery?
- Can they provide electronic data deliverables in an acceptable format?

Consider logistics:

- When to order sample containers?
- How to handle and store samples from collection to delivery while maintaining chain-of-custody?
- Deliver samples by hand or ship them? Shipping instructions?
- How to ensure samples maintain correct temperatures. Store in cooler or fridge or freezer? Ship frozen samples overnight?
- What paperwork does the lab require? Labs typically require a chain-of-custody form with signatures.

Calculate a lab analysis budget:

- Determine the number of routine samples you will collect (number of sites x number of visits)
- Determine the number of duplicate samples you will collect (10% of routine samples)
- Determine the number of field blanks you will prepare (one per sampling trip per analyte)
- Calculate the cost per analyte (total number of samples x price per analyte)
- Add shipping costs, if applicable